K-12 Digital Information Systems:

More Than a Screen and a Keyboard

Presented to
the General Assembly,
Chief Information Office, Department of Education, and Education Oversight Committee

By the
TechThink Work Group
July 2008

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Executive Summary

The future vitality of our state's economy depends on the ability of South Carolinians to use computers and digital information systems, to adopt and adapt to this "information age." The key to stimulating this economic development is a K-12 education system that has the ability to teach digital information systems and 21st century skills. Other states and nations are moving quickly to provide financial support to ensure their students take advantage of this fast developing information economy.

In the 1990s, South Carolina took a national lead in establishing K-12 information systems; however, the benefits of this early investment and the digital information equality achieved across the state have diminished without ongoing state support.

The General Assembly's 2007 report, "Study on the Feasibility and Cost of Converting the State Assessment Program to a Computer-Based or Computer-Adaptive Format," urged a focus on the integration of technology into instruction in order to improve instruction and work-force readiness. This study clearly established that schools' infrastructure gaps impede integration of technology in daily instruction and implementation of computer-based assessment.

The TechThink Work Group recommends:

The State provide funds for the K-12 education's digital information systems

- so that infrastructure, human resources, and professional development meet national "moderate or satisfactory" efficiency standards
- in order to provide for instruction that embeds digital information systems and assessment in all of our schools and school districts.

Actions to achieve these goals include:

✓ Increase state funding for broadband to $3 million for greater access. The General Assembly should request annual estimates of the state funds required so that schools and districts have sufficient broadband access. .

✓ Establish an annual technology line item funded at $338 per student to implement the TechThink Work Group recommendations outlined below.

✓ Provide annual assistance with the cost of district and school infrastructure maintenance and upgrade. The annual $122 per pupil cost allows a four-year phase-in and is based on the report that half of the needed structure is currently in place.

✓ Fund technical staffing for infrastructure support and network management to one technology staff per 250 computers. This follows the national standards for "low to moderate" efficiency although the ratio is still far short of the business average of 1:50 computers. As the state further implements information systems embedded instruction, the state should provide assistance for one technical staff to 100 computers.

✓ Fund one data quality specialist for each district and for every school or group of schools with 500 students. Data quality specialists are important to the process for improving the timeliness and quality of data collected from schools and districts. Support for technology and data quality staff is estimated to cost $43 per student annually.

✓ Establish standards for pre-service teacher training so that beginning teachers are better prepared to utilize the schools' information systems in instruction.

✓ Fund training and require information systems standards for all educators – teachers, administrators, state agency personnel, and teacher preparation faculty. To sustain this training for each educator every three years requires annual expenditures equal to $10 per pupil. Training for technology staff must be provided more frequently.

✓ Fund one computing device per student in order to fully embed information systems into instruction and learning and to move to computer-based assessment. The devices will vary in capability and power, depending on the students' grade levels, and would consist of a keyboard, Internet access, and a quality screen. With $163 per pupil for four years, the equipment is phased-in for all students; continuing that amount in following years allows for appropriate replacement cycles.

Summary of Digital Information Systems Costs			
	Annual per Pupil (Rounded)	**Total Annual**	**Terms and Conditions**
School/District Infrastructure	$122	$83,399,322	assumes 50% of hardware already in place, cost over 4 years, weighted for elementary, middle, high schools, allows for on-going up-grade over time
Tech/Data Staffing	$43	$29,169,255	assumes some staff in place, cost over 4 years
Prof. Development/Training	$10	$6,863,354	$1000 per staff, one-third every year
1:1 Computing	$163	$111,426,963	over 4 years, weighted for elementary, middle, high schools, allows for on-going up-grade over time
Total	**$338**	**$230,858,894**	

The $338 does not include the costs of assistive technology for special needs students, subject specific requirements such as graphing calculators and science probes, computers for educators, or expenditures required to prepare facilities for technology. The TechThink Group considers $338 per pupil to be a reasonable amount to invest to prepare students for the "information future." Such an investment returns South Carolina to the forefront in K-12 information systems within four years; continuing the support sparks the state's economic development.

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Greeting the Future

The future is here. It's just not widely distributed yet.
William Gibson (coined the term *cyberspace*)

The future vitality of our state's economy depends on the ability of South Carolinians to use computers and digital information systems, to adopt and adapt to this "information age." Business and industrial leaders repeatedly state that the work force must be able to use digital information systems and that the key to stimulating economic development is the ability of our K-12 education system to teach 21st century skills - skills that include navigating the Internet, locating, evaluating, synthesizing, and communicating information.

In 2007, a General Assembly mandated study urged the state to focus on the integration of technology in instruction as a way of improving instruction and work-force readiness. Unfortunately, Data Recognition Corporation's study established that the schools' infrastructure gaps impede integration of technology in daily instruction and implementation of computer-based assessment. The study advised the General Assembly to consider investments in K-12 information systems infrastructure within the overall context of an enhanced and equitable instructional environment for all students ("Study on the Feasibility and Cost of Converting the State Assessment Program to a Computer-Based or Computer-Adaptive Format" referred to hereinafter as the DRC study).

Other states and nations are moving quickly to provide financial support to ensure their students can take advantage of this fast developing information economy. Will these investments pay off? The World Bank reported that poverty in Asia has been cut in half over the past decade due to information technologies and the competitive advantage offered in high value-added industries and services (Reported in the Christian Science Monitor, April 18, 2008).

For example:

- Kentucky refreshed its K-12 system infrastructure – funding Ethernet routing switches, firewalls, and content filters for its 174 districts – and so providing all its students equal access to online courses, testing, and communications.
- Maine has a statewide laptop program in all its middle schools and some high schools.
- England will spend $200 billion over the next 15 years to make all of its high schools and half of its elementary schools state-of-the-art technology schools. The British government argues that if technology is treated as a fundamental building block in school design, education has a major opportunity to transform learning for all learners.
- Peru is delivering 486,500 XO laptops to every elementary student in its 9,000 remote schools this year. XO is a $180 computer that uses wireless Internet access.
- Australia's Victoria Province connected its 1,630 schools to a wireless network, now the largest of its type in the southern hemisphere. Each classroom connects to its own curriculum site on the school Intranet.

Why This Report

In the 1990s, South Carolina took a national lead in K-12 information systems: wiring all schools for Internet access, installing a new data collection system, and implementing student and teacher technology standards. However, the benefits of the state's early investment in K-12 information infrastructure and the information equality achieved across the state have diminished without ongoing state support because:

technology advanced,
education software required more memory and power,
information demands increased and changed, and
equipment aged.

Currently, state funding covers only the cost of maintaining schools' Internet connectivity.

In response to the findings of the DRC study regarding our schools' infrastructure gaps, the TechThink Work Group convened to examine the capacity South Carolina's schools need to integrate technology information systems into instruction in all schools and to recommend the improvements needed to enable transition to computerized testing.

A coalition of the Department of Education, the Education Oversight Committee, and the Chief Information Office of the Budget and Control Board initiated the TechThink Work Group. The 26 members represent a variety of business and education responsibilities including chief executive officers, technology directors, accountability officers, deputy superintendents, program evaluators, and teachers. Private industry and state agencies are both represented. The TechThink Group and its writing committee met throughout the spring of 2008.

To adequately fund the recommendations outlined in this report, the TechThink Group recommends that an annual technology line item be funded at a level of $338 per student.

Capacity = Infrastructure, Human Resources, and Training

Everything comes to us that belongs to us if we create the capacity to receive it. Rabindrnath Tagore (Indian poet, playwright, essayist and Nobel Prize winner)

The capacity to provide and instruct using information systems and to establish computerized assessment demands three interdependent elements: infrastructure, human resources, and professional development/training.

The importance of state funding for all three elements cannot be over-emphasized – in order for education to prepare our future work force and the state to move to computer based assessment. Schools need an adequate technology infrastructure, but the "stuff" requires the human resources to maintain the system and assist in its use along with professional development to support the use of the information. South Carolina's school districts need state support to obtain and maintain the tools and resources for the infrastructure, to support current and future information systems, and to encourage embedded information system use in the classroom.

The DRC study surveyed schools and concluded there was insufficient infrastructure, too few instructional computers, and inadequate numbers of technology support staff to allow for information systems integrated instruction or computer based assessment. The study also found a need for training and professional development programs prior to implementing computer-based assessment. The TechThink Group stipulates that concentrated training for the state's teaching staff is vital to implementing quality integration of technology and information systems into instruction.

Information Systems and Schools

Business and industry leaders discuss the need for the workforce to possess 21st century skills and the American public agrees. In a survey of registered voters conducted September 2007, 70 percent defined computer and technology skills as "basic skills." They also see critical thinking and problem-solving skills as core 21st century skills. Those polled ranked these abilities as almost as important as reading comprehension to competing in today's economy. (Partnership for 21st Century Skills, "Voter Attitudes toward 21st Century Skills")

South Carolina already has incorporated computer and technology skills in its academic standards and instructional guidelines, but the state needs to ensure that our schools have the capacity to utilize information systems and to help students gain the needed skills. Additionally, schools need support for the information systems that are central in every function of the delivery of education today: instruction, assessment, professional development, administration, safety/security, and community information/involvement. All rely on information systems. See Chart 1 on the following page.

State planning for the future of information systems in K-12 education must build on current infrastructure and support structures. Technology changes quickly but while some "emerging technologies" require new equipment, others take advantage of systems already widespread in use. The TechThink Group believes that the schools must have the capacity to take advantage of the continuing development of hardware, software, and systems. The report outlines the short-term and long-term steps necessary to ensure that the capacity is available; the report does not detail the specific hardware, software, or personnel needed.

Chart 1
Examples of Uses of Information Systems in SC's Schools
Not All Available in All Schools

Student Information

student profile
parent information
courses and course history
program participation
discipline
teacher history
funding classifications
assessment reporting (calculations of AYP, etc. for over 2100 districts, schools, grade levels)
(tracking of student success on high school exit exam, end-of-course tests)
electronic student transcript

Information Provision

Virtual Schools (courses online for students)
DISCUS (state library access to all data bases for research)
StreamlineSC (integrated source for all material available to teachers through ETV)
Computerized diagnostic testing)

Safety

security systems
drivers' license checks
camera/surveillance systems
automatic e-mails, phone notifications for parents during emergencies
incidence tracking for federal and state reports

Health

Medicare billing
student medicine administration

Community/Communications

local board meeting materials
choice applications and notifications
standards and assessment information
parent portal

Professional Development

teacher employment and certification status
tracking software
training modules
curriculum maps

Administration

financial reporting and auditing
class scheduling
textbook coordination and tracking
library management
grade books
statistical analysis and data reconfiguration
classroom/building utilization

Building Capacity

State funding must support:

- up-dating the K-12 technology infrastructure so that all schools have the capacity to meet current and future needs,
- establishing technology staffing levels throughout the state so that they meet "low to moderate efficiency" standards, and
- providing the training capacity to support the use of the infrastructure and information in every school.

Building Capacity: Infrastructure

The most immediate need in the K-12 technology infrastructure is an increase in the broadband capacity and wireless access for student and teacher use. The very backbones of technology -- routers, switches, cabling, and servers -- need upgrading or replacement from the early state provided system. The State needs to support the cost and renewal of the software utilized in schools and districts to provide instruction, meet reporting needs, and support the daily functions of the education system.

You can't be too rich or have too much bandwidth.
Johnson's Law of Network Capacity

Broadband South Carolina's school districts and schools depend on the state's broadband system for instructional, accountability, and administrative purposes. Broadband provides high-speed data transmission capable of carrying vast quantities of data simultaneously. The broadband system is students' avenue to the Internet and access to research and information. The system is also the schools' pathway to gathering, retrieving, analyzing, and reporting information. If the education system is to further integrate information systems into teaching and learning and establish computer based assessment, broadband capacity must increase now.

Districts use caching and other mechanisms to overcome broadband limits now. Yet 15 of the 85 districts are paying locally for additional bandwidth and more districts would do so if funds permitted. Demand is growing because many districts and schools are only now beginning to integrate information systems into their curriculum.

In addition, the need for additional bandwidth is driven by increasing requirements for data, both from and by our schools; as well as increasingly sophisticated education software that requires higher performance rates. The state is implementing its virtual school and many districts use on-line diagnostic testing with their students. On a day-to-day basis, the 700,000 faculty and student users in our schools require more bandwidth than a typical office or industry. Further, implementation of computer-based testing will demand even greater bandwidth. The TechThink Group recommends the General Assembly provide funding for expanding broadband access so that every district has 100 Megabit Internet links. Approximately $3 million in state funds is needed during the 2009-2010 school year to increase access. The General Assembly should request annual estimates of the state funds required to ensure sufficient broadband access.

Wireless The TechThink Group stresses that the state must also increase wireless access to emphasize 21st century skills and, in the future, enable computer based assessment. Good broadband access and wireless capability complement each other. Schools need both for embedded information system instruction: broadband easily carries large amounts of data and larger programs than wireless; wireless gives easier access for large numbers of users.

The Southern Regional Education Board (SREB) points out that wireless technology can overcome the time and location constraints of traditional brick-and-mortar educational structures. Wireless gives increased flexibility and opportunities for tailored learning experiences. Teachers report their students are more engaged in learning and more willing to extend an activity past class time. Students experience a deeper understanding and a more effective match with their learning styles ("Why are Wireless Services Important to State and Education Leaders?" March 2005). Wireless connections reduce the number of wires run to classrooms and wireless devices can move wherever needed within a local area.

An increase in wireless capabilities serves more than K-12 education. As the Rock Hill Herald put it, "Access to the Internet in this day and age is like a utility, a necessary service people need to keep pace with a changing world. Wireless technology also is an increasingly necessary tool in classrooms, offices, and homes." (May 13, 2008)

What technology first makes possible, it soon makes imperative.
Johnson's Rule of Technology Implementation

Equipment Replacement The TechThink Group stresses the need for state financial support for replacement and upgrade costs for the infrastructure immediately. Routers, cabling, servers, and switches all wear out or become obsolete. Replacements and up-grades are an on-going cost for information systems. The hardware schools bought with state support 10 years ago has passed its four- to five-year life expectancy, is no longer efficient, and has insufficient strength and complexity to meet the increased, and increasing, demand by schools.

South Carolina's districts usually use their equipment until it dies. Some poor districts maintain computer labs by using hand-me-downs from districts that can afford to upgrade. While this practice puts computers in the hands of students who otherwise would not have them, these old machines lack the memory and speed needed for many of today's education software programs, participation in the state's virtual school, or handling computer based assessment.

In the DRC survey, almost 40 percent of the districts stated that it would be five or more years before they upgraded their computer fleet or that they had no planned upgrade. This inability to upgrade is more than unfortunate in an area where three- to five-year-old equipment is considered seriously outdated. Further, the support costs increase greatly for devices kept past the usual life cycle. State support will enable schools and school districts to strive for the "moderate to high efficiency" standards established by International Society for Technology in Education (ISTE) and the Gates Foundation (See Appendix B).

Software An often overlooked but on-going expense for information systems is the purchase and renewal costs for anti-virus, anti-spam, tracking modules, content filtering, library management, and finance support software. In addition, fees for instructional software, for reading and math systems for example, are annual.

Information systems are central to all functions of schools as well as to instruction. The cost of software adds up very quickly. The TechThink Group found an average annual expenditure of $30 per student for operational software and a minimum of $10 a student for instructional software. A district of 7,500 students can easily spend $300,000 a year just for e-mail, filtering, firewall, and anti-virus, as evidenced by districts represented in the TechThink Group. Without state support for at least half the cost, the software gap impacts the schools' ability to provide quality technology and information systems.

Building Capacity: Human Resources

The stuff is not enough. Johnson's Technology Planning Rule

Schools' hardware and software must be "good to go" at all times in order for teachers to use them in instruction. These systems are available only when there is the staff to keep them operational. The state's focus for funding education is, correctly, on the classroom; however, information systems cannot be embedded in instruction without the support of technology staff. Also, schools must enter data into the systems correctly in order to be able to use it accurately later. Keeping up with the data is now a full-time job.

Technology Staff The TechThink Group recommends that the state fund the national standard for "low to moderate efficiency" technology support staff for infrastructure support and network management to one technology staff per 250 computers (ISTE and the Gates Foundation). As the state moves forward to integrate information systems in instruction, a "high efficiency" ratio of 1:100 should be funded.

Most end-users who use Word Perfect, Word, Excel and Quicken are not familiar with the time consuming tasks of server configuration, installation, support, and maintenance. With luck, those users do not need to manage Internet access, virus control, and e-mail spam. They do not worry about copyright compliance, or try to track down rogue software. Many have a help desk or tool available when the software sputters or the computing device hiccups.

All of these functions fall on school district infrastructure and network management staff. The business world averages one technology employee per 50 computers. The TechThink Group estimates the state ratio is close to 500 computers to one technology person. Two districts represented on the TechThink Group reported a ratio of one technology staff to 850 and 650 computers, respectively.

With more and more devices such as smart phones, voice mail, and video being used in education, technology personnel are asked to do more and support increasing quantities of hardware and software. This responsibility comes on top of an overload of computers alone.

No matter what the object, if it has a power cord, someone will expect you to fix it. Carol Schwartz, technology staff

Data Quality Staff Gigabytes of data are collected on every aspect of the state's educational process with the amount growing exponentially in the last 15 years. The state's student reporting system (SASI) has 320 data fields that must be completed and kept up-to-date for every student. Accurate information must be maintained on such aspects as enrollment, withdrawals, class scheduling, attendance, suspensions, tardies, grades, teacher data, and

health needs. While the focus of education must be on the classroom and on instruction, there also must be an emphasis on data quality. Data mistakes can cost a school funding, impact federal rankings, imply school safety issues, and endanger program support. Without attention to the accuracy of the data, districts and schools might mislabel worthwhile programs, deprive students of graduation credit until the mistakes are found, and misreport student performance

Education data collection is an on-going activity because information is collected, revised, and amended every day. To assist with data quality and improve the process, the TechThink Group recommends that the state fund a data quality staff person for each school or group of schools totaling 500 students and one data staff person for every district The data quality staff help reinforce the data accuracy process in the school and district as they maintain the student reporting database, use data checking tools to verify the correctness and completeness of data, and take the necessary measures to eliminate data problems. The data quality positions can draw attention continuously to the data quality needs of the education system.

Teaching Staff Research concludes repeatedly that education leadership and teacher training are critical to the success of any digital information system for instruction and learning. These findings, reported in the Harvard Letter, echo those of the SREB report and a University of Connecticut study.

Teaching and learning in the K-12 public schools depend on the "human element" -- the quality of interaction between teacher and student and among students. The use of digital information systems does not change the importance of excellent interpersonal relationships. In fact, the TechThink Group knows the use and success of student training on and about information systems all comes back to the human factor – knowledgeable teachers, trained technology personnel, and informed leadership make learning possible.

Building Capacity: Professional Development/Training

Training empowers users to take advantage of whatever information systems are available and enables them to make better choices as to the needs of their schools, districts, and students. Student use of, and success with, information systems depends upon knowledgeable teachers, trained technology personnel, and informed leadership.

The empires of the future are the empires of the mind.
Sir Winston Churchill

Preservice Training Embedding information systems in training at the pre-service and in-service levels is critical, for the majority of our teachers became teachers prior to the information age. The 30 college and university teacher preparation institutions in South Carolina each have different technology and information systems requirements for pre-service. Several institutions require specific technology courses for graduation; other institutions have few or no technology requirements for their pre-service candidates.

The result of these uneven expectations in our teacher preparation institutions is new teachers with inconsistent and often inadequate preparation in the use and knowledge of information systems. The TechThink Group recommends that the Department of Education develop specific requirements for the certification of new teachers related to information systems and their use. Each teacher preparation institution should be required to provide the training

necessary to meet those requirements and to ensure that its curriculum and teaching methods model good use of information systems and strategies. The National Educational Standards for Teachers, revised Summer 2008, should serve as the basis for the requirements.

Professional Development The TechThink Group recommends that information systems knowledge and training be required for all certified education staff, not just for teachers, as is currently the case. The TechThink Group further recommends inviting faculty from teacher preparation institutions to participate in the training to ensure they too are familiar with the needs and demands of data, technology, and information systems. The current standards for teachers should be modified, as needed, to reflect the 2008 revision of the ISTE standards.

Many school and district administrators, as well as state department staff and college faculty, entered the education profession prior to the pervasive use of information technology in schools and districts. In order to serve as instructional leaders and chief operating officers of their districts, administrators must be informed and involved in technology developments.

The TechThink Group further recommends that educators receive targeted training every three years since technology and software in education is changing so rapidly. There is a need for many different types of training for educators:

- Data systems in use at the school/by the district
  - Method, impact, and uses of the data
- What teachers can learn from technology and with technology
- Education software available and subject specific resources
- Uses of various types of technologies, pros and cons and best use
  - How students learn "from" technology and learn "with" technology
- Reworking and creating instructional modules to embed information systems and encourage 21st century skill development and use
- Reworking teaching strategies to emphasize engagement, individualized instruction
- Training and retraining on new and emerging technology and software

Training for teaching staff should include time for further practice and planning of new teaching strategies. It is also beneficial to include follow-up training to encourage the use and development of the teaching strategies. Essential questions often emerge only after several months of use. The TechThink Group recommends that funding for training include an amount sufficient for practice and planning.

Assessing and Training for Capacity The TechThink Group recommends that the Department of Education develop or adapt state technology standards and establish on-going training that uses these standards to improve district and school capacities in embedding information systems instruction. A number of national and state groups, for example, the International Society for Technology in Education (ISTE), State Educational Technology Directors Association (SETDA), California, and Arizona, have technology standards for determining the capability and efficiency of a technology system. Some states require that district superintendents, administrators, technology staff, and faculty representatives participate as a group in state training that begins with a self-examination based on the standards. The training then uses the standards to educate the school and district groups as to the next steps they need to take to move to a more effective and efficient use of digital information systems.

Technology Staff Training Technology staff training can be very expensive since instruction on technologies is usually available only from the one provider and requires several days of training. Often, the staff must travel to a city where the training is offered. Many times, the

technology staff is the last to receive funding for training. As South Carolina refreshes and upgrades its infrastructure, technology staff training must remain a part of the capacity issue and be included in the state support for training.

Embedding Information Systems and Student Computing

South Carolinians would never think of supplying a school with only three pencils per classroom; nor can the state consider only two or three computers per class to be adequate. Yet in the DRC study, 73 percent of the state's schools reported three or fewer average number of computers for student instruction per classroom. These statistics indicate we expect seven students to be able to make use of one computer, if the class size is 21. In business, particularly the information, development, or research sectors, individuals rarely share computing devices. Work on and with information systems requires ready access. This access is important since skills with applications can be lost if not used; also information generated on the computer requires further access with the computer.

1:1 Computing Devices To minimally prepare our students for further education or a career and to support computer based assessment, the TechThink Group recommends a phase-in of state support for a ratio of one computing device to one student. These devices would not be laptops necessarily; one type of device does not fit the needs of all grades or all learning situations. The computing devices will vary in capability and power, depending on the students' grade levels, and would consist of a keyboard, Internet access, and a quality screen. Think of an advanced smart phone or a cross between a phone and a laptop.

The cost and size of computing devices continues to fall while power increases. Consumer Reports (June 2008) recommends budget laptops available for less than $1,000. These devices have a 15-inch screen, 2GB of RAM, integrated graphics, and a DVD burner – the power and functions needed for the state's virtual school, computer based assessment, or the newer education software. A number of small notebooks offering full functionality and quick Web access are on the market now for under $700. (The XO, the $180 device, lacks full functionality and its low price is less and less a bargain as other inexpensive technologies develop.)

As equipment is updated and added, districts should establish standards for performance, system requirements, and software, as is recommended by ISTE. Donated equipment and equipment purchased with grants should all meet the district standards. Without such criteria, schools end up with multiple platforms, operating systems, and non-standard installations which result in inefficiencies and high costs of support and maintenance.

A direct, causal relationship between technology and student achievement is difficult to establish but research shows that with the introduction of a new technology into the classroom, other positive changes also occur. Students learn "from" technology when they use, for example, software to improve word recognition, and they learn "with" technology, as when using the Internet for original source research.

The North Central Regional Education Laboratory (NCREL), a federally funded research group, reviewed the research and summarized the findings. A meta-analysis review of research conducted between 1993 and 2000 on the effectiveness of educational software found evidence of a positive association between use of the software products and student achievement in reading and mathematics. Earlier reviews of the research literature found students in the early

grades, from pre-K to grade three, and in the middle school grades appear to benefit most from software applications for reading instruction, as do students with special reading needs.

Research linking technology integration, inquiry-based teaching, and an emphasis on problem solving with student achievement – learning with technology – is only beginning but suggests a positive connection. The Southern Regional Education Board (SREB, March 2005) asked if technology is effective in providing opportunities for improved student academic achievement for rural high school students. Their research found that the "overwhelming answer is yes, when leadership, funding, and support" provide the motivation and means to move forward. Other researchers are more cautious. The Harvard Education Letter (May/June 2008) looked at one-to-one computing and reported preliminary evidence that the programs lead to improved achievement. Laptop programs are linked to higher attendance, better discipline and more effective classroom practices.

Capacity = Funding

To adequately fund the recommendations outlined above, the TechThink Group recommends funding an annual line item for digital information systems at a level of $338 per student. Of this amount, $122 provides in four years for 50 percent of infrastructure and continuing that funding allows the districts and schools to keep pace with changing technology. Increases in technology staff and data quality staffing use $43 of the $338. The staff is put in place in four years. Professional development every third year for each educator costs $10 per pupil annually. A four-year phase-in of one computing device for each student costs an additional $163 annually. See Appendix A for details of the cost calculations.

Summary of Digital Information Systems Costs			
See Appendix A for details			
Number of pupils =	683,601		
	Annual per Pupil (Rounded)	**Total Annual**	**Terms and Conditions**
School/District Infrastructure	$122	$83,399,322	assumes 50% hardware already in place, cost over 4 years, weighted for elementary, middle, high schools, allows for on-going up-grade over time
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information systems within four years; continuing the support sparks the state's economic development.

It may be possible to offset some costs by replacing textbooks and some instructional materials with e-books and alternative instructional materials. Should support for the full $338 per pupil be unavailable, the TechThink Group recommends that the state focus on support for broadband, infrastructure and staffing needs first. However, districts and schools should have the option to use the funds in their most needed technology areas. The TechThink Group recommends that the funds be disbursed based on a per pupil amount.

The TechThink Group is aware of discussions underway to up-date and overhaul the funding system for K-12 education. TechThink urges that when establishing any funding method or pupil amount, the General Assembly take into consideration the cost of digital information systems.

For tomorrow belongs to the people who prepare for it today.
African Proverb

Resources and Articles Used in Researching K-12 Digital Information Systems: More than a Screen and a Keyboard

American Association of School Librarians. "Standards for the 21st-Century Learner." 2007. <www.librarycareers.org/ala/aasl/aaslproftools/learningstandards/standards.cfm>

Arizona Department of Education. Education Technology Leadership Sources. <www.ade.az.gov/technology/LeadershipResources/>.

"Arizona VOI Case Study, One-to-one Student Computing." Consortium for School Networking, CoSN. July 2007. <www.edtechvoi.org>.

"Australian Schools Assert Technology Leadership with Cisco Wireless Network." Cisco Systems. 2005. <www.cisco.com/en/US/prod/collateral/wireless/ps5678/ps430/prod_case_study0900aecd80321a65.html>.

Brown, Ken. "Plan and Deliver." *techLearning.* April 22, 2008. <www.techlearning.com/showArticle.php?articleID=19660517>.

California School Information Services. <www.csis.k12.ca.us/e-learning/reg-main.asp>.

"Computers, The new shape of laptops and desktops." *Consumer Reports.* June 2008.

"Connecting Policy and Data: What legislators need to know about state education data systems." *EIMAC Brief.* Council of Chief State School Officers. June 2007.

Data Recognition Corporation. "Study on the Feasibility and Cost of Converting the State Assessment Program to a Computer-Based or Computer-Adaptive Format, Final Report." Columbia, South Carolina. June 25, 2007. <http://eoc.sc.gov/NR/rdonlyres/005CF7BA-A43F-421B-AB04-72B8B8B6E4A3/5535/SCFeasibilityFinalReport.pdf>.

Davis, T., Fuller, M., Jackson, S., Pittman, J., Sweet, J. "A National Consideration of Digital Equity." International Society for Technology In Education. 2007. <www.iste.org/digitalequity>.

"Digital Transformation, A Framework for ICT Literacy." International Information and Communication Technologies Literacy Panel. 2001. <www.ets.org/Media/Tests/Information_and_Communication_Technology_Literacy/ictreport.pdf>

Gillard, Colleen. "Equity, Access, and Opportunity." *Harvard Education Letter.* 24:3 (2008).

Gravina, Robert J. "Everyone's Going Wireless, So Why Aren't We"?. *The School Administrator.* (May 2007). <www.aasa.org/publications/saarticledetailtest.cfm?ItemNumber=8837>.

Griffin, Dianne and Billie Sherrod, "Technology Use in Rural High Schools Improves Opportunities for Student Achievement." Southern Regional Education Board. Atlanta. March 2005. <www.sreb.org/programs/EdTech/pubs/PDF/05T01-

TechnologyUseinRuralHS.pdf>.

Honey, Margaret. "Critical Issue: Using Technology to Improve Student Achievement." North Central Regional Education Laboratory. 2005. <www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm>.

"MIT/Stanford 'Total Cost of IT' Project." Information Services and Technology, Massachusetts Institute of Technology. August 2005. <web.mit.edu/costs/index.html>.

"In Kentucky, No Child Left Offline." *District Administration.* May 2008

International Society for Technology in Education. "Technology Support Index." <http://tsi.iste.org/techsupport/tech-support-index-2.4.pdf>.

International Society for Technology in Education. "National Educational Technology Standards for Administrators." 2002. <www.iste.org/Content/NavigationMenu/NETS/ForAdministrators/NETS_for_Administrators.htm>.

International Society for Technology in Education. "National Educational Technology Standards for Students." September 2007. <www.iste.org/Content/NavigationMenu/NETS/ForStudents/2007Standards/NETS_for_Students_2007.htm>.

International Society for Technology in Education. "National Educational Technology Standards for Teachers." July 2008. <www.iste.org/Content/NavigationMenu/NETS/ForTeachers/NETS_for_Teachers.htm>.

"Investing in the Future." Microsoft Press Release. February 4, 2002. <www.microsoft.com/presspass/features/2002/feb02/02-04newzealand.mspx>.

Johnson, Doug, Machines Are the Easy Part; People Are the Hard Part: Observations about Making Technology Work in Schools. Second Edition. Cleveland, MN. Blue Skunk Press. 2004/2008. <Lulu.com>.

Kurzweil, Ray. "Expect Exponential Progress." *The Christian Science Monitor.* April 18, 2008. <www.csmonitor.com/2008/0418/p09s01-coop.html>.

KnowledgeWorks Foundation. *Learning to Adapt, Final Report*. Prepared for the South Carolina Education Oversight Committee. August 15, 2005.

Levin, Douglas and Sousan Arafeh. "The Digital Disconnect: The widening gap between Internet-savvy students and their schools." Pew Internet & American Life Project. April 22, 2008. <www.perinternet.lorg/PPf/r?67?report_display.asp>.

Mathews, J. B. "Why are Wireless Services Important to State and Education Leaders?." Southern Regional Education Board. Atlanta. March 2005. <www.sreb.org/programs/edtech/pubs/PDF/05T02-Why_Wireless_Important.pdf>.

McIntire, Todd. "Enough to Go Around? Budget and TCO Too Kit." *School CIO*. <www.schoolcio.com/showArticle.php?articleID=18900853>.

Miners, Zech and Angela Pascopella. “Students are immersed in 21st century ‘new literacy’ technologies, but are schools preparing them for the future?.” *District Administration.* October 2007. <www.districtadministration.com/viewarticlepf.aspx?articleid=1292>.

Nagel, Dave. “Classroom Technology ‘Woefully Inadequate,” Study Finds.” theJournal. June 2008. <www.thejournal.com>.

Prensky, Marc. “Reaching the Reluctant Learner.” *Education Leadership.* 65:6 (2008): 40-45.

Prouty, Doug. “What can we do about School Tech Support?.” <www.thesnorkel.org/PDF/techsupport.pdf>.

San Diego County Office of Education and Imperial County Office of Education. TechSETS. <www.techsets.org/>.

“SETDA urges schools to boost bandwidth.” eSchoolNews. June 25, 2008. eschoolnews.com/news.

“Statewide Web Access?.” *The Herald*. May 13, 2008. <www.heraldonline.com>.

Software & Information Industry Association. “SIIA Vision for K-20 Education.” <www.siia.net/visionk20/index.html>.

Stansbury, Meris. “Schools need help with tech support.” *eSchool News.* January 9, 2008. <www. Schoolnews.com>.

“Special Reports: 10 Emerging Technologies 2008.” *Technology Review.* March/April 2008. <www.technologyreview.com/specialreports/specialreport.aspx?id=25>.

Talbot, David. “Una Laptop por Nino.” *Technology Review.* May/June 2008. <www.technologyreview.com/printer_friendly_artilce.aspx?id=20572>.

“2006 One-to-one VOI Case Studies.” Consortium for School Networking (CoSN). March 2006. <www.classroomtco.org>.

“2006 Progress Report.” *South Carolina K-12 Technology Initiative.* State Budget and Control Board. 2006.

Tynan, Dan. “The Next 25 Years in Tech.” *PCWorld.* January 30, 2008. <www.pcworld.com/printable/article/id,141792/printable.html>.

“U.S. Students Need 21st Century Skills to Compete in a Global Economy.” Partnership for 21st Century Skills. October 2007. <www.21stcenturyskills.org/index.php?option=com_content&task=view&id=369&Itemid=64>

“Voter Attitudes toward 21st Century Skills. Partnership for 21st Century Skills.” 2007. <http://www.21stcenturyskills.org/documents/P21_pollreport_singlepg.pdf>

Appendix

Appendix A
Calculations for K-12 Digital Information Systems

Basis for Technology Costs

Costs are based on modeling. Specifics of the 7,500 district are shown on the following pages. Teaching and administrative staffing for district and schools are based on the 2007 Funding study conducted for the State Superintendent.

Element	Product	Cost	Comments
Student devices	Dell Inspiron 1525	$499 - $799	these more than meet computer-based assessment requirements, and can handle virtual school functionality
	HP Pavilion 6700	$799	80-160 GB Hard Drive, 1 GB Memory 15" screen, video card, wireless
			amounts included in study assume some state discounts
Docking stations	Dell DSH-100U2	$70	since others more expensive, used full cost
Classroom Printer/Scanner	HP Deskjet F4180 & F4280	$80	used full cost so better scanner with state discount
School All-in-one	HP Laserjet CP3505	$600 - $1550	used $800 so state contract should give needed item
Interactive whiteboards	DP Presentation Markerboard	$1,400	used $2000 to include projector and installation kit
	IdeaShare Markerboard	$2,000	
Servers	Dell Rack Servers - Elite	$5,300	special Internet price, so used $6000
Cabling, Routers	$30 per student		CoSN cost studies, district information
Wireless access	$100 per student		CoSN cost studies, district information
Professional Development		$1000 per professional staff	with the current costs

Appendix A

Calculations for K-12 Digital Information Systems

District Technology Costs (Size = 7,500)

Number of schools = 12 (7 elementary, 3 middle, and 2 high)

	Units	Cost each	Per Pupil	Refresh/ Phase-in Cycle	Annual Cost
Human Resources					
1 Technology/instructional technology staff per 250 computers	31-5.5=25.5	$40,000.00	$136.00	4	$34.00
Data Quality Staff - 1 per school + district	13	$20,000	$34.67	4	$8.67
Total for Tech/Data Staff			**$170.67**		**$42.67**
Infrastructure					
Servers district level	10	$6,000.00	$8.00	4	$2.00
per SC survey: number of servers in a district range from 6-15					
additional servers - 2 per school	24	$6,000.00	$19.20	4	$4.80
cabling, switches, routers	cost total	$225,000.00	$30.00	4	$7.50
wireless access points	cost total	$750,000.00	$100.00	4	$25.00
Renewal costs (anti-virus, firewalls, etc.)	cost total	$225,000.00	$30.00	2	$15.00
Renewal costs instructional software	cost total	$75,000.00	$10.00	2	$5.00
Total for Infrastructure		$1,287,000.00	**$197.20**		**$59.30**
Training/Professional Development		$1,000 per cert. staff	**$30.13**	3	**$10.04**
	Per Pupil Cost		**$398.00**		**$112.01**
ISTE Technology Support Index (moderate to satisfactory efficiency standards) served as basis for elements.					

Computer Load	
teachers and school staff	168
district staff	27
computer labs	42
total district computers to support	237
students' computing devices	7500
total for tech support	7737
divided by 250 per tech staff	31

District and School models and staff levels from '07 Task Force (not including the number of proposed technical and data quality staff)

Appendix A
Calculations for K-12 Digital Information Systems

Elementary Technology Costs
school Size = 500

INFRASTRUCTURE	Units	Cost each	Per Pupil	Refresh/ Phase-in Cycle	Annual Cost
Student computing devices 1:1	500	$500.00	$500.00	4	$125.00
Docking stations to connect to secure school, school, state software	500	$75.00	$75.00	4	$18.75
Total for 1:1 Computing			**$575.00**		**$143.75**
Classroom/School Equipment					
Multimedia Workstations for Teachers	38	$1,200.00	$91.20	4	$22.80
Printer/scanner/copier in each classroom	38	$80.00	$6.08	4	$1.52
Interactive whiteboard 1 per classroom	38	$2,000.00	$152.00	4	$38.00
All-in-one printer 2 per elem	2	$800.00	$3.20	4	$0.80
Media Center Equipment					$0.00
Networked Computers - 8 basic	8	$1,500.00	$24.00	4	$6.00
Networked Printers - 2 basic	2	$800.00	$3.20	4	$0.80
Additional Media Computers (1 for every 150Ss)	2	$1,500.00	$6.00	4	$1.50
Total for School Infrastructure			**$285.68**		**$71.42**
	Per Pupil Cost		**$860.68**		**$215.17**

Middle School Technology Costs
School Size = 750

INFRASTRUCTURE	Units	Cost each	Per Pupil	Refresh/ Phase-in Cycle	Annual Cost
Student computing devices 1:1	750	$600.00	$600.00	4	$150.00
Docking stations to connect to secure school, school, state software	750	$75.00	$75.00	4	$18.75
Total for 1:1			**$675.00**		**$168.75**
Classroom/School Equipment					$0.00
Multimedia Workstations for Teachers	45	$1,200.00	$72.00	4	$18.00
Printer in each classroom	45	$80.00	$4.80	4	$1.20
Interactive whiteboards	45	$2,000.00	$120.00	4	$30.00
All-in-one printers -2 middle school	2	$800.00	$2.13	4	$0.53
Media Center Equipment					$0.00
Networked Computers 8	8	$1,500.00	$16.00	4	$4.00
Networked Printers 2	2	$800.00	$2.13	4	$0.53
Additional Computers (1 for every 150 students)	5	$1,500.00	$10.00	4	$2.50
Total for Infrastructure			**$227.07**		**$56.77**
	Per Pupil Cost		**$902.07**		**$225.52**

Appendix A
Calculations for K-12 Digital Information Systems

High School Technology Costs

School Size = 900

INFRASTRUCTURE	Units	Cost each	Per Pupil	Refresh/ Phase-in Cycle	Annual Cost
Student computing devices 1:1	900	$700.00	$700.00	4	$175.00
Docking stations to connect to secure school/district/state software	900	$75.00	$75.00	4	$18.75
Total 1:1			**$775.00**		**$193.75**
Classroom/School Equipment					
Multimedia Workstations for Teachers	48	$1,200.00	$64.00	4	$16.00
Printer/scanner/copier in each classroom	48	$80.00	$4.27	4	$1.07
Interactive whiteboards	48	$2,000.00	$106.67	4	$26.67
All-in-one printers - 2 per school	2	$800.00	$1.78	4	$0.44
Media Center Equipment					$0.00
Networked Computers	10	$1,500.00	$16.67	4	$4.17
Networked Printers	2	$800.00	$1.78	4	$0.44
Additional Computers (1 for every 150 students)	6	$1,500.00	$10.00	4	$2.50
Total School Infrastructure			**$205.16**		**$51.29**
	Per Pupil Cost		**$980.16**		**$245.04**

Appendix B
International Society for Technology in Education

Version 2.4

Technology Support Index

Domain One – Equipment Standards

	Support Capacity and Efficiency				
	Low Efficiency	**Moderate Efficiency**	**Satisfactory Efficiency**	**High Efficiency**	**Fiscal**
Cycling of Equipment	No replacement cycle has been defined.	Equipment is placed on a replacement cycle greater than 5 years.	Equipment is placed on a 4–5-year replacement cycle.	Equipment is placed on a 3-year or better replacement cycle.	$$$$
Brand Selection (e.g., Compaq, Dell, Apple, IBM, etc.)	No brands are specified; purchasing is done by price only, and is site controlled.	A district brand is selected, but changes from year to year depending upon what vendor is providing the best selection at the time.	A district brand has been selected, typically for more than one year, but is not strictly enforced allowing for purchasing of some equipment that is outside the standard.	A district brand has been specified, and all purchases are made within that brand over an extended period of time.	Neutral
Model Selection	There are no limitations on model selection.	A model line has been selected, but many choices are given within that line.	A model line has been selected, and choices are limited to 3–5 models.	Model selection is limited to one or two, with few variations.	Neutral
Platform (e.g., Apple, Windows, Sun)	The district supports two or more platforms, and platform choice is left to individuals in the district.	The district supports two or more platforms, but choices are made by schools at large and are generally uniform.	The district supports two platforms with one predominant platform for general use, and a second platform for specific programs and/or instructional applications.	One platform only is selected for district computers regardless of application. Instructional applications may be compromised.	Neutral
Standard Operating System (OS) (e.g., Win 3.x, Win95, Win98, Win2K, Mac 8, Mac 9, Apple II, etc.)	Four or more OS versions are used, and all are "supported" by the district.	Three OS versions are used, and the older OS computers are either migrated or receive no support.	Two OS versions are used, with most equipment migrated to the most recent OS.	One OS version is used district-wide, with all computers migrated to that OS.	$$
Application Software Standard	No software standards have been established.	Software standards are established. Nonstandard installations are permitted and some support is provided.	Software standards are established. Nonstandard installations are allowed but no local support is provided.	Software standards are established and only those applications on the list are permitted on computers.	Neutral
Donated Equipment	Donated equipment is accepted with no regard to whether it meets district equipment standards.	Donated equipment is accepted with minimum performance requirements with no regard to brand or age.	Donated equipment is accepted with minimum performance requirements and suggested brand. Equipment is less than 3 years old.	Donated equipment is accepted but only if it meets specific brand, model, performance, and system requirements. Equipment is less than 2 years old. Cash donations are encouraged so new standard equipment can be purchased.	Neutral
Granted Equipment	Grant equipment decisions are made by the grantee or grantor and are not influenced by the district.	The district is consulted regarding grant equipment. Cash grant equipment is purchased according to the standard. Equipment grants are readily accepted regardless of brand.	All cash grants meet district specifications. Equipment grants are approved before submittal, by the technology department. Standardization is encouraged.	All grant equipment, purchased and given, must meet district specification or it isn't allowed on the district network or in the school.	Neutral

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Technology Support Index

Domain One – Equipment Standards

	Support Capacity and Efficiency				
	Low Efficiency	**Moderate Efficiency**	**Satisfactory Efficiency**	**High Efficiency**	**Fiscal**
Peripheral Standards (e.g., printers, scanners, digital cameras, projectors, video, etc.)	No peripheral standards are set.	Peripherals are standardized by brand but models within the brand are not. The peripheral standards change frequently and are rated for consumer use.	Peripherals are standardized by brand and model, but the list contains many options with some consumer-rated items.	All peripherals are standardized, with specific models identified that are primarily rated for industrial/school use. Brands and models are limited.	$
Surplus Practice	Equipment isn't added to surplus until it is no longer usable and is supported as resources allow.	Surplus equipment is supported by district personnel but as a low priority.	Surplus equipment is no longer supported by district personnel but can be used by schools until it breaks.	Surplus equipment is taken out of service when it reaches the replacement age even if it still works. Equipment is donated to students when possible.	Neutral
Break/Fix Agreements (Warranties)	No additional warranties are pursued beyond the standard warranty (1 year).	Extended warranties are purchased but do not cover the life of the equipment and does not include peripherals (3 year, computers only).	Extended warranties are purchased to extend the standard warranty on computers and peripherals but do not cover the equipment lifespan (3 year, all equipment).	Warranties are purchased to cover the life of the equipment (5 or more years).	$$$
Security Procedures	Security guidelines and common practice are loosely defined or do not exist creating substantial security vulnerabilities.	Fairly secure guidelines are in place but are not followed closely. Both guidelines and practice provide vulnerabilities.	Fairly secure guidelines are in place and followed, but more stringent guidelines would provide better security (e.g. no password rotations, etc.).	Very secure guidelines are in place and are consistently practiced including limited admin access, password rotations, and alpha-numeric password protocols.	Neutral
Security Hardware and Software	No firewall exists and there are no security software standards in place.	A firewall is in place but ports are commonly opened. Software security standards are limited to promises by the vendor with no auditing activity.	A firewall is in place and opening of ports is limited. Software security standards are in place for major systems along with periodical security audits.	A firewall is in place and opening of ports is very limited. Software security standards are in place for ALL systems along with periodic security audits.	$$

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Technology Support Index

Domain Two – Staffing and Processes

	Support Capacity and Efficiency				
	Low Efficiency	**Moderate Efficiency**	**Satisfactory Efficiency**	**High Efficiency**	**Fiscal**
Organizational Structure	Direction comes from multiple points within the organization, and reporting is not functionally logical. Cross-functional collaboration is difficult or non-existent.	The reporting structures are difficult to identify, and direction comes from multiple points in the organization. Cross-functional collaboration exists.	The technical support functions and instructional technology functions report differently, but each unit is cohesively organized and there is communication between units.	All of the technology functions report through the same unit in the organization, providing for a logical chain of command and communication structures with the unit clearly supporting the district mission.	Neutral
Contracted Primary Support	No contracts are used for **primary** support. Contracted support may be used as a supplementary strategy.	All support is contracted out, but the contract provides personnel minimums rather than a performance contract.	All support is contracted out and written to a specific performance contract requiring a 5 day maximum turnaround.	All support is contracted out and written to a specific performance contract requiring no more than a 72 hour turnaround.	$$$$$
If Contracted Primary Support is used, skip to the Escalation Process at break, otherwise continue					
Contracted Supplemental Support	Contracted support is not used.	Contracted support is used for emergencies, but not as a part of the overall support strategy.	Contracted support is used as part of the overall support strategy, but has not been evaluated to determine the most strategic places and circumstances to use contractors.	Contracted support is strategically used as an effective part of the overall support strategy to solve complex problems and/or realize savings and efficiencies.	$$$
Staffing to Computer Ratio	Computer-to-technician ratio is over 250:1.	Computer-to-technician ratio is between 150:1 and 250:1.	Computer-to-technician ratio is between 75:1 and 150:1.	Computer-to-technician ratio is less than 75:1.	$$$$$
Formula-Driven Technology Staffing (e.g., X computers + X network drops + X applications divided by Y = # of technicians)	Staffing formulas are not used or considered.	Formulas for staffing are considered but are limited in scope and are not used to drive staffing.	Comprehensive formulas have been developed, considering multiple dimensions of the environment, but are only used as a guide and do not drive staffing.	Comprehensive formulas have been developed and drive staffing as a normal part of operations. Formulas include multiple dimensions of the environment.	$$$$$
Certification of Technical Staff	Certification is not a priority in the organization and concerns are raised about time away from the job to pursue certification.	Appropriate technical staff is encouraged to become certified, but no support is provided towards certification.	Some technical staff is certified in appropriate areas, others are involved in district-supported programs towards certification.	Most technical staff is certified in appropriate areas (e.g., A+, Cisco, CNE, MCSE, etc.) and new certifications are strongly encouraged and district supported.	$$
Differentiated Job Descriptions	Technical support employees do it all creating redundancies and inefficiencies.	Technical support employees do it all, but redundancies are not created due to size and/or staffing levels.	Some differentiation in jobs has occurred, although assignments are not provided based upon skill-set competencies.	Job descriptions are fully differentiated creating specialization and efficiencies, and a clear avenue for support.	Neutral
Technician Retention	Employee turnover is high primarily due to low employee satisfaction.	Employee turnover is high primarily due to other employment opportunities.	Employee turnover is moderate (excluding retirement), and employee satisfaction is good.	Employee turnover is low (excluding retirement), and employee satisfaction is high.	$

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Domain Two – Staffing and Processes

	Support Capacity and Efficiency				
	Low Efficiency	**Moderate Efficiency**	**Satisfactory Efficiency**	**High Efficiency**	**Fiscal**
Competitive Compensation	Technical positions are poorly competitive, offering compensation in the bottom 50% of equivalent organizations in the area.	Technical positions are moderately competitive, offering compensation in the 50th to 75th percentile of equivalent organizations in the area.	Technical positions are competitive, offering compensation in the 75th to 90th percentile of equivalent organizations in the area, and offering competitive non-compensation benefits.	Technical positions are very competitive, offering compensation in the 90th percentile of equivalent organizations in the area, and in some cases, competing with private businesses for talent.	$$$
Continue from here if Primary Contracted Support was selected, all others continue					
Escalation Process for Technical Issues	No escalation process is in place, and the path for resolution is unclear.	A clear path for resolution is in place, but no escalation process is recognized.	An escalation process is in place with two steps of escalation and significant crossover between levels.	A well-defined escalation process is in place, with three or more steps of escalation, and a clear path for resolution.	$
HelpDesk	No HelpDesk support is provided.	A HelpDesk is provided but is not adequately staffed. The HelpDesk is used for emergencies, not as the first line of defense.	A central HelpDesk is in place and staffed, but it is not used systemically as the first line of defense.	A central HelpDesk is in place with trained staff, and the district culture embraces the HelpDesk as the first line of defense.	$$
Use of Online Knowledgebase for Technical Help	Staffs seek no help from online help both due to availability of resources and district culture.	Some staff seeks online help, but the behavior is not pervasive and the resources are limited.	Many staff seeks online help and there are several broad resources available. Use is not organizationally pervasive.	Most staff seeks help from online knowledge bases as their first resource for help from diverse and comprehensive resources. This is a pervasive part of the culture.	$$
Software Support Protocols and Standards	No list of supported software is provided for users.	A list of supported software is provided, but no differentiation is made for the kind of support a given category of software will receive.	A list of supported software is provided and differentiation is made for the kind of support a given category of software will receive; however, users do not follow the different processes closely.	A list of supported software is provided, with clear differentiated support processes for each set of software that are consistently used.	Neutral
New Equipment Deployment	The school and local staff are responsible for the deployment of new equipment.	The technical staff manages deployment of new equipment requiring a substantial reduction in regular service during deployment.	Additional help (internal or contracted) is utilized for imaging and tagging of equipment, but setup is the responsibility of the regular technical staff creating some delays in regular service.	Additional help (internal or contracted) is utilized for all deployment functions providing no delays or disruptions in regular technical service.	$$
Documented Procedures	Little or no documentation exists for technical tasks — requiring users and technical staff to invent their own solutions.	Some documentation exists for technical tasks but is not widely shared or used. Most documentation is limited to few technical staff only.	Documentation exists for many technical tasks but is not well written and is not systematically updated as procedures are developed.	Documentation exists for most technical tasks and is used by most user groups. Well-written documentation production is a normal part of operations.	$$

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Technology Support Index

Domain Two – Staffing and Processes

	Support Capacity and Efficiency				
	Low Efficiency	**Moderate Efficiency**	**Satisfactory Efficiency**	**High Efficiency**	**Fiscal**
Support by Teachers	Teacher(s) provide all of the technical assistance in the building.	Teacher(s) provide much of the technical assistance in the building with release time or stipend.	Teacher(s) serve as the contact point, and perform some of the technical work in conjunction with technical staff.	Teacher(s) are used as the contact point in the building, but do not perform technical support work.	Neutral
Student Support	Students provide support for the school in an ad-hoc manner due to limited district support. No technical support curricular program exists for students.	Students are used extensively, in an official capacity and substantially supplant district support.	A curricular program is designed to train students in technical support. Students are used to supplant some of the district's support system but are not considered the official technical support strategy.	A curricular program is designed to train students in technical support. They support district technology but in a peripheral way as part of their instructional program only.	Neutral

Technology Support Index

Domain Three – Professional Development

	Support Capacity and Efficiency				
	Low Efficiency	**Moderate Efficiency**	**Satisfactory Efficiency**	**High Efficiency**	**Fiscal**
			APPLIES TO ALL STAFF		
Comprehensive Staff Development Programs	There is no formal staff development program in place, and training is provided infrequently. The organization depends upon individuals' own motivation to build expertise.	A staff development program is in place but is limited, voluntary, and uses a single dimension in its delivery.	A staff development program is in place. It is not comprehensive in nature in that it does not impact all staff and does not offer the depth required to change the organization.	A comprehensive staff development program is in place that impacts ALL staff. The program is progressive in nature and balances incentive, accountability, and diverse learning opportunities.	$$$$$
Online Training Opportunities	Online training opportunities do not exist.	Online training opportunities exist, but are limited in scope and are available to a limited number of employees.	Online training opportunities are available for staff onsite and remotely, but are limited in their offerings.	Online training opportunities are provided for staff both onsite and remotely, and represent a diversity of skill sets.	$$
Just-in-time Training	No just-in-time training process or delivery system has been put into place.	Just-in-time training is used, but the process and delivery system has not been refined so that it can be used realistically within the organization.	A process and delivery for just-in-time training is in place, but has not been adopted by the organization as a mechanism for solving issues.	A process and delivery system has been established for just-in-time training organization-wide and is used consistently.	$$
Expectations for All Staff	Expectations of staff are not clearly defined and are not part of the organizational culture.	Expectations of staff are articulated but are limited in scope.	Expectations of staff are articulated and are broad in scope, but have not been adopted as part of the organizational culture.	Expectations for all staff are clearly articulated and are broad in scope. Performance expectations are built into work functions and are part of the organizational culture.	Neutral
Troubleshooting as Part of Professional Development	No form of troubleshooting is integrated into the professional development program.	Troubleshooting is built into the professional development program but is limited in scope and is provided inconsistently. Roles and responsibilities are not clearly defined.	Troubleshooting is built into the professional development program and is used as a major strategy for technical support. Technical versus end-user roles and responsibilities are not clearly defined.	Basic troubleshooting is built into the professional development program and is used as a first line of defense in conjunction with technical support.	$
			APPLIES TO TECHNOLOGY SUPPORT STAFF ONLY		
Training for Technical Staff	Technical staff is only given training to take care of the immediate issues in the district. Advanced training is not encouraged.	Technical staff receives consistent training around emergent issues. Advanced training is not district sponsored but is encouraged.	Technical staff receives consistent training around emergent issues and have limited district-sponsored opportunities for advanced training.	Technical staff receives ample training as a normal part of their employment, including training towards certification.	$$

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Technology Support Index

Domain Four – Enterprise Management

	Support Capacity and Efficiency				
	Low Efficiency	**Moderate Efficiency**	**Satisfactory Efficiency**	**High Efficiency**	**Fiscal**
Trouble Ticketing System	No trouble ticketing system exists.	A simple trouble ticketing system is in place, but is not electronic and/or is simple in its implementation, not allowing for universal tracking of issues and establishing trends.	A trouble ticketing system is in place and is used extensively for responding to technical issues. Analysis of issues, response times, and possible trends is not done systematically.	All technical issues are recorded and delegated to appropriate resources through an electronic trouble ticketing system. All technical issues are tracked and evaluated through this system.	$$
Virus Protection	No virus software is used.	Virus software is used, but it is client-based and therefore often out of date.	Server-based virus software is used, but the parameters for its use are loosely defined and updates are not consistent.	Server-based virus software is available, used, and automatically updated.	$$
Network Infrastructure and Bandwidth	Network access is limited and is not available in every location.	Network access is available to all locations, but does not impact all computers and is limited in bandwidth.	Network access is available to all locations but segments of the network are limited in bandwidth.	Robust broadband network access is available to all locations allowing for network tools to be effectively utilized.	$$$$
Desktop and Software Standardization Tools (Profiles)	No desktop standardization tools or practice are used.	Desktop standardization tools are in place, but are mostly ignored once the equipment is deployed.	Desktop standardization tools are in place, but changes users make are not automatically corrected.	Desktop standardization tools are used to provide a common desktop for all users and access to common software. Changes to the desktop are automatically corrected.	$
Network Sniffing Tools	No network sniffing tools are used.	Network sniffing tools are used for problem diagnosis only.	Network sniffing tools are used for problem diagnosis and limited preventative maintenance.	Network sniffing tools are used to both diagnose problems and establish performance matrices for preventative maintenance. The network is systematically monitored using these tools.	$$
Online Knowledgebase	No online knowledgebase is present.	An online knowledgebase is in place, but it is limited in scope and is not readily used in the organization.	An online knowledgebase is in place and is employed by users. It is not designed to easily expand and users do not use it as a first line of defense.	An online knowledgebase is in place and is expansive in its detail. It is used readily and automatically grows based upon trend data generated in other tracking systems.	$$
Integrated and Systemic Electronic Communication	Electronic communication is limited and has little use for providing technical support.	Electronic communication is available to many staff but is not integrated at all into the daily work of employees.	Electronic communication is available to everyone in the organization but is not readily used for technical support.	Electronic communication is available to everyone in the organization and is integrated into daily work so that it can be used for technical support.	$
Remote Computer Management	No remote management is available.	Remote management is available for servers only.	Remote management is available for all computers but is not used extensively.	Remote management is available for all computers and is used as a primary strategy of support.	$$$

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Technology Support Index

Domain Four – Enterprise Management

	Support Capacity and Efficiency				
	Low Efficiency	**Moderate Efficiency**	**Satisfactory Efficiency**	**High Efficiency**	**Fiscal**
Imaging Software	Imaging software is not used.	Imaging software is used in the most primitive sense — only providing recovery services with the imaging software provided by the vendor.	An image is used for delivery of the machine but is not used to clone all of the software on the machine. Only the basic OS and basic software is imaged. Imaging is used as a troubleshooting strategy.	Imaging software is used for delivery of new machines, and as a troubleshooting strategy. Software installed through the imaging process is comprehensive.	$
Metering and Application Push Technology (e.g. SMS or ManageWise)	Metering and Push technology is not used as a support strategy.	Metering and Push technology is used for metering but is not used for installation and updates, and its use is limited in scope.	Metering and Push technology is used for metering and some software updates, but major software installations are handled on the individual computer.	Metering and Push technology is used for all software distribution, technical updates, and for metering of software use on the district's computers.	$$
Server Farms and Centralized Services	Every site has its own server and, in some cases, multiple servers. Backup and server management takes place locally.	Each site has only one server with some services (e.g., e-mail, student information system, etc.) provided centrally.	Many servers are consolidated into a few locations and most services are provided centrally.	All servers and services are centralized requiring minimal server management outside of one location.	$$$
Application Service Providers (ASPs)	No ASP services are utilized.	One or two ASP services are used, but it does not impact support due to the peripheral nature of the product.	A number of district or commercial ASP services are used but is limited to one category of software (e.g., productivity, research, libraries, content, etc.).	A district or commercial ASP model is used for most major software applications after a thorough cost/benefit and risk analysis.	$$$
Thin-client Computing	Thin-client computing is not used.	Thin client is used but is limited to a small number of users for specific applications.	Thin client is used for most users of administrative systems and some productivity software. (Not instructional applications)	All administrative and productivity software for staff is delivered through a thin-client model. (Not instructional applications)	$$$
Vendor-specific Management (e.g., Insight Manager)	Vendor tools are not installed or considered when purchasing hardware.	Vendor tools are available and have been purchased but are mostly unused.	Vendor tools are used in a limited way for diagnosis and prevention.	Vendor tools are used extensively for diagnosis of issues, to streamline processes, and for preventive measures.	$
Quality Assurance (QA) and Customer Follow-up	Surveys are conducted generally as part of other departmental survey work within the organization or not at all.	QA surveys are conducted, but they are not automated and are only done annually.	Surveys specific to technical support are conducted. However, they are done only periodically, and the data is used sporadically.	QA is measured by a random and automatic system that tracks customer satisfaction and closed tickets. Data is collected throughout the year. Questions asked are specific to technical support and the data is used to make adjustments.	$

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Appendix B
International Society for Technology in Education

Technology Support Index

Domain Four – Enterprise Management

	Support Capacity and Efficiency				
	Low Efficiency	Moderate Efficiency	Satisfactory Efficiency	High Efficiency	Fiscal
Student/Fiscal/HR/ Assessment Systems	Student/Fiscal/HR/Assessment systems are not in place.	Student/Fiscal/HR/Assessment systems are partially in place, but are not reliable or intuitive.	Student/Fiscal/HR/Assessment systems are in place and are reliable, but do not integrate well with other systems and are not intuitive.	Student/Fiscal/HR/Assessment systems are in place, reliable, intuitive, and integrate nicely with other productivity tools.	$$$

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